



EVALUATION OF MANAGER PERFORMANCE USING FUZZY LOGIC TECHNIQUES

Ragini Shukla¹ | Manoj Kumar²

¹ Asst. Prof., Department of IT, Dr. C. V. Raman University, Bilaspur, Chhattisgarh, India.

² Research Scholar, Department of IT, Dr. C. V. Raman University, Bilaspur, Chhattisgarh, India.

ABSTRACT

Most companies and Organization use performance appraisal system to evaluate the manager's performance. The manager's performance is very important to the management of company and as well as industrial organizations. In which usually involves crisp and uncertain values to evaluate manager's performance. In this paper we proposed to evaluate managers performance on the basis of different factors, applying into fuzzy inference system (FIS), FIS is the process of formulating the mapping from a given input to an output using fuzzy logic. We can consider some of the most relevant factors, and developed rules will be fuzzified. As input fuzzy variable performance will be fuzzified with suitable fuzzy linguistic variable and ultimately FIS will be developed. This paper explains the comparison of two different membership function and getting more or less similar, So as to achieve the shape of membership function, which is not playing much role to evaluate the performance in positive or negative direction.

KEYWORDS: Performance Appraisal, management and employee Cascaded, Fuzzy Inference System, Sensitivity Analysis, Fuzzy membership, Fuzzy Rules.

I. INTRODUCTION:

According to company managements point of view, we find managers performance suppose some manager beginning is good and his Leadership is not good or some managers knowledge is bad but his time management is excellent. managers skill affiance to inculcate the work in company value plays vital role. Hence there is need for evaluation of manager's performances. Evaluating the performance of a manager is very necessary due to many reasons. There are

- Improvement of the company/organization
- Monitoring of the employee
- Betterment of the self-improvement

The feedback form that is being made to evaluate the performance of manager is based on some crisp value (fixed value) which is not at appropriate. Proposals to use manager performance incentives as the basis for organizations reforms have recently attracted considerable attention and support among researchers and policy makers. The main message is that the most likely way to improve company's achievements is to company performance incentives, direct monetary rewards for improvements in company employee's outcomes. However, there has been very little experience with applying performance incentives in companies.

To evaluation the manager's performance, I purpose to take the help of company employee's feedback form to apply fuzzy logic. As fuzzy logic is a tool which can be applied in uncertain simulation, must of the factor while evaluate manager performance are uncertain, Vaguer. Say for example how factor cannot be measured with some crisp value, it may be better to have bad, good, better, best etc. which is fuzzy linguistic variable and in this research paper managers performance is evaluated. So, first we should survey the manager's requirements and company requirements. Then researcher must interact the managers and get some knowledge about manager's. Researcher should meet different managers in the company should meet different natures of managers. I will meet managers for companies and big organizations, and also meet small industrial managers. All have given some ideas about the finding the managers performance

Managers performance is very important to the should as well as organizations. In this research, I just find managers performance towards the organizations. Organization point of view, manager must have the 1) Leadership 2) Experience 3) Communication 4) Knowledge 5) Time management 6) Reliability 7) Delegation 8) Confidence 9) Respect for Employees Parameters are required.

Those parameters I choose best of the best 1) Leadership 2) Communication 3) Knowledge 4) Time management 5) Reliability all those parameters will be helpful to find out the managers performance.

II. METHODOLOGY:

Fuzzy Logic:

Fuzzy logic is a form of many-valued logic in which the truth values of variables may be any real number between 0 and 1 inclusive. It is employed to handle the concept of partial truth, where the truth value may range between completely true and completely false. By contrast, in Boolean logic, the truth values of variables

may only be the integer values 0 or 1. The term fuzzy logic was introduced with the 1965 proposal of fuzzy set theory by Lotfi Zadeh. It is based on the observation that people make decisions based on imprecise and non-numerical information, fuzzy models or sets are mathematical means of representing vagueness and imprecise information, hence the term fuzzy. These models have the capability of recognizing, representing, manipulating, interpreting, and utilizing data and information that are vague and lack certainty.

Different membership Function:

A membership function for a fuzzy set A on the universe of discourse X is defined as $\mu_A: X \rightarrow [0, 1]$, where each element of X is mapped to a value between 0 and 1. ... Membership functions allow us to graphically represent a fuzzy set. The membership degree quantifies the grade of membership of the element to the fuzzy set. The value 0 means that is not a member of the fuzzy set; the value 1 means that is fully a member of the fuzzy set. The values between 0 and 1 characterize fuzzy members, which belong to the fuzzy set only partially.

There are different forms of membership functions Fig 1 shows as: Triangular, Trapezoidal, Piecewise linear, Gaussian, Singleton.

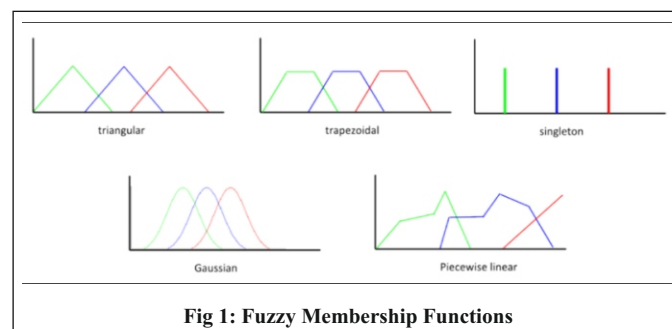


Fig 1: Fuzzy Membership Functions

Fuzzy Inference System:

Fuzzy Inference System is the key unit of a fuzzy logic system having decision making as its primary work. It uses the "IF... THEN" rules along with connectors "OR" or "AND" for drawing essential decision rules.

Functional Blocks of FIS:

The Fig 2 shows the following five functional blocks will help you understand the construction of FIS –

- Rule Base** – It contains fuzzy IF-THEN rules.
- Database** – It defines the membership functions of fuzzy sets used in fuzzy rules.
- Decision-making Unit** – It performs operation on rules.
- Fuzzification Interface Unit** – It converts the crisp quantities into fuzzy

quantities.

- *Defuzzification Interface Unit* – It converts the fuzzy quantities into crisp quantities. Following is a block diagram of fuzzy inference system.

Table 1: Input Variables and Ranges

Input	Input Name	Linguistic	Range
Input 1	Leadership	Assertive	1-50
		Powerful	25-75
		Highly competent	50-100
Input 2	Communication	Unimpressive	1-50
		Impressive	25-75
		Very impressive	50-100
Input 3	Knowledge	Bad	1-50
		Good	25-75
		Very good	50-100
Input 4	Time management	Imperfect	1-50
		Perfect	25-75
		Excellent	50-100
Input 5	Reliability	Nonreliable	1-50
		Reliable	25-75
		Highly reliable	50-100

Table 2: Output Variable and Range

Output	Output Name	Linguistic	Range
Output 1	Performance	Poor	1-40
		Good	40-80
		Excellent	80-100

III. FUZZIFICATION:

Fuzzification comprises the process of transforming crisp value into grade of membership for linguistic terms of fuzzy sets. The membership function is used to associate a grade to each linguistic term.

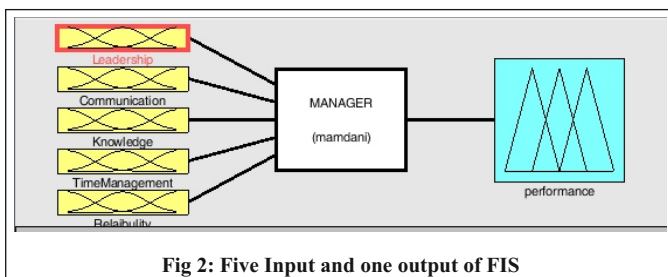


Fig 2: Five Input and one output of FIS

Figure 1 describes the we select the five parameters and one output of the managers activities and apply to the FIS and arrange the rules then we evaluate the managers performance.

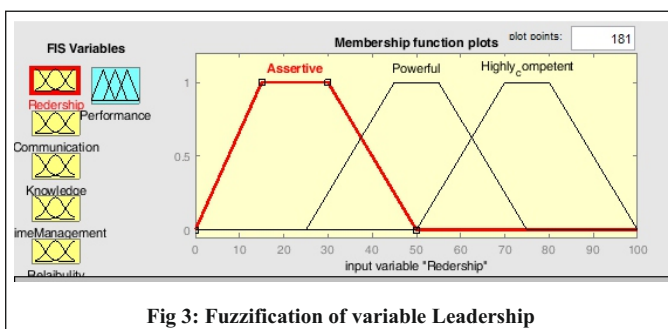
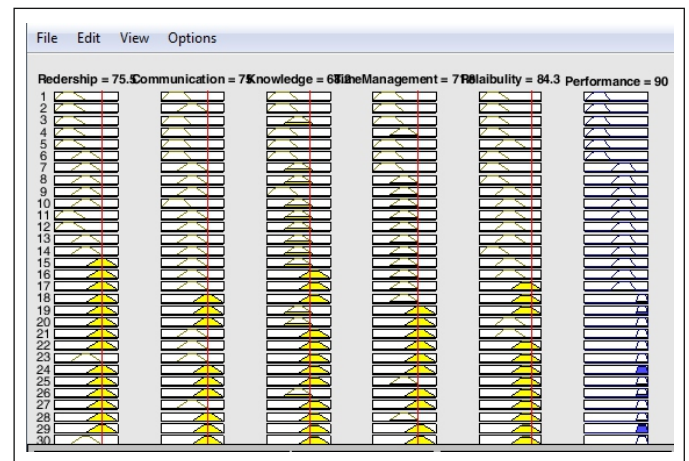


Fig 3: Fuzzification of variable Leadership

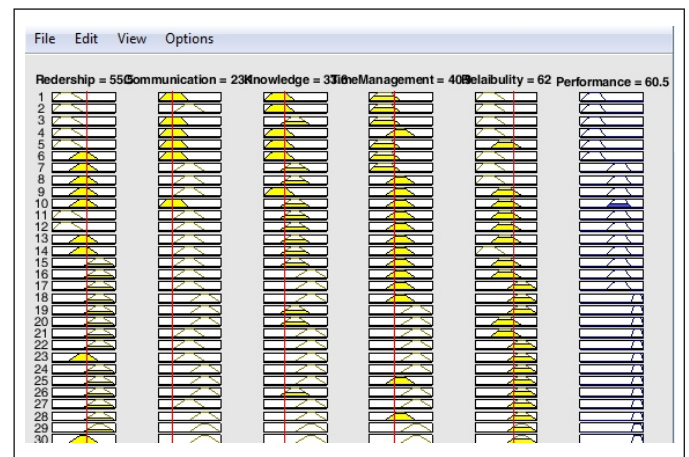
Figure 3 shows fuzzification of output parameter performance with their triangle membership function and its corresponding range as explain in table 2, the membership function are touching with each other for achieving better results.

IV. RULE BASED:

As per the input and output parameters fuzzified as shows in fig 1 to fig 3 rule base is generated by applying my own reasoning as an expert person to observe or taking decision to Evaluate the performance of a manager. There are 30 numbers of rules generated using 'AND' and 'OR' operator. The overall rules are written below 1, If (Leadership is bad) then (performance is poor 11, If (Leadership is powerful) and (communication is impressive) and (knowledge is good) then (performance is good) 20, If (Leadership is highly competent) and (communication is impressive) and (knowledge is good) and (time management is perfect) then (performance is good) 34, If (Leadership is highly competent) and (communication is impressive) and (knowledge is good) and (time management is perfect) and (reliability is highly reliable) then (performance is excellent).



The above Figure: Inference process when Leadership = 75.3, communication = 73, knowledge = 63.3, Time management = 70.5, Reliability = 84.3 then performance = 90



The above Figure: Inference process when Leadership = 55.3, communication = 23.4, knowledge = 33.3, Time management = 40.5, Reliability = 62 then performance = 60.5

S. No	Input					Output
	Leadership	Communication	Knowledge	Time Management	Reliability	Trapezoidal Outputs
1	16.2	16.4	16.2	16.7	16.8	20.9
2	25	25	25	25	25	20.4
3	31	31.3	32.3	34	34	48
4	46.2	47	46.5	45.3	46.8	45.7
5	57.2	57	57.3	57.3	56	67.2
6	66.2	65.8	65.7	66.7	66.8	71
7	68	74.5	69.4	75	74	76.1
8	82	82.4	81.2	72	70.5	80.8
9	73.5	81.1	70.5	82.8	84.1	87.8
10	78.2	82.4	85.6	87.2	87.5	90

The above Table: Inference process when Leadership = 78.2, communication = 82, knowledge = 85.6, Time management = 87.2, Reliability = 87.5 then performance = 90

S. No	Input					Output
	Leadership	Communication	Knowledge	Time Management	Reliability	Trapezoidal Output
1	16.2	16.3	16.9	17	17.5	20.3
2	27	26	27	25.8	26.3	20.4
3	35	35	36	37	38	48
4	47.3	47.5	47.3	48	48	55.6
5	58	58.3	58.6	58.2	58.3	68.5
6	65.9	65.5	65	65.7	65.8	71
7	68.8	76.5	70.5	75	72	76.1
8	87.1	83.3	84.4	78	70.5	80.8
9	73.5	81.1	70.5	82.8	84.1	87.8
10	87.5	89.2	86.4	86.5	87.2	90

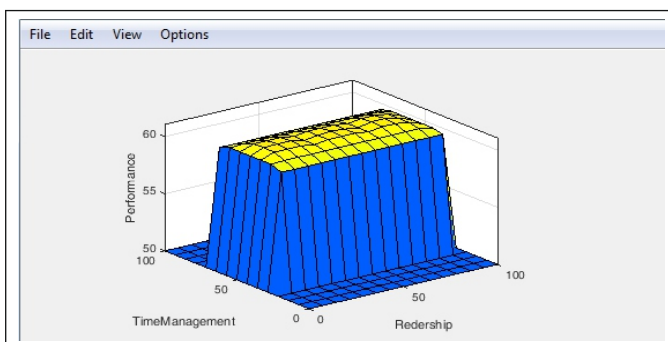
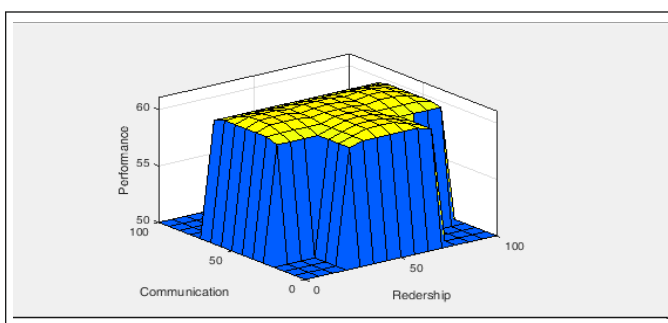
The following table shows that how inference engine works for different input values. If we observe this table minimally then one can say that for different values of input parameters the output (performance) that is produced by FIS more or equal to output of triangular.

S. No	Input					Output	
	Leadership	Communication	Knowledge	Time Management	Reliability	Triangular Output	Trapezoidal Output
1	16.2	16.4	16.2	16.7	16.8	20.9	20.3
2	25	25	25	25	25	20.4	20.4
3	31	31.3	32.3	34	34	48	48
4	46.2	47	46.5	45.3	46.8	45.7	55.6
5	57.2	57	57.3	57.3	56	67.2	68.5
6	66.2	65.8	65.7	66.7	66.8	71	71
7	68	74.5	69.4	75	74	76.1	76.1
8	82	82.4	81.2	72	70.5	80.8	80.8
9	73.5	81.1	70.5	82.8	84.1	87.8	87.8
10	78.2	82.4	85.6	87.2	87.5	90	90

In the above table an example is demonstrated by and my point of view is taking arranging input values for getting the output as manager performance in shape triangular and trapezoidal membership functions.

Suppose Sno.1: Leadership range is 16.2, communication range is also 16.4, knowledge range is also 16.2, time management range also 16.7, reliability range is 16.8 then performance in triangular shape we get 20.9 and also trapezoidal shape we get 20.3.

Sno.10: Suppose Leadership range is 78.8, communication range is also 82.4, knowledge range is also 85.6, time management range also 87.2, reliability range is 87.5 then performance in triangular shape we get 90 and also trapezoidal shape we get 90.



Three dimensional of surface viewer of rule base explains the Leadership is on X-axis and communication is Y-axis with respective to performance on Z-axis.

V. CONCLUSION:

We have developed FIS with different input parameters to evaluate the performance of manager using two different membership functions triangular and trapezoidal and compared the performance. Result shows that in both the cases the performance in percentage we are getting is more or less similar,

So we can conclude that the shape of membership function is not playing much rule to evaluate the performance in positive or negative direction.

REFERENCES:

1. Bhosale G.A., "Fuzzy Inference System for Teaching Staff Performance Appraisal" 2013, IJCIT.
2. Chen W, Panahi M, Performance evaluation of GIS-based new ensemble data mining differential evolution (DE) and particle swarm optimization (PSO) for landslide spatial modeling 2017, IEEE.
3. DarshanKumar and JagdevSingh A fuzzy logic based decision support system for evaluation of suppliers in supply chain management practices, 2013, Elsevier.
4. Gokhan Gokmen, Evaluation of student performance in laboratory applications using fuzzy logic 2010, ELSVIER.
5. Imtiaz Ahmed and Ineen Sultana, Employee performance evaluation: a fuzzy approach, 2013, (IJPPM).
6. MahdiSabaghi "Sustainability assessment using fuzzy-inference technique (SAFT): A methodology toward green products" 2016, Elsevier.
7. Sirigiri P, Gangadhar P.V.V.S, Evaluate E-Government Security Strategy by using Fuzzy Logic Techniques, 2012, Global journals.
8. Yadav RS, Singh VP Modeling Academic Performance Evaluation Using Soft Computing Techniques: A Fuzzy Logic Approach 2011, IJCSE.
9. Yang L, Entchev E, Performance prediction of a hybrid micro generation system using Adaptive Neuro Fuzzy Inference System (ANFIS) technique 2014, Elsevier, International Journal of Computer Trends and Technology- volume 3 Issue 2- 2012 ISSN: 2231-2803 <http://www.internationaljournalssrg.org> Page 205
10. Zadeh L.A., Fuzzy algorithms, Info. & Ctl., Vol. 12, 1968, pp. 94-102.
11. Zadeh L.A., Fuzzy Sets, Information and Control, 1965.
12. Zadeh L.A., Making computers think like people, IEEE. Spectrum, 8/1984, pp. 26-32.
13. Zadeh L.A., Outline of A New Approach to the Analysis of Complex Systems and Decision Processes, 1973.